Serologic Investigation of an Outbreak of Hepatitis A In a Rural Day-Care Center

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Abstract: We studied an outbreak of hepatitis A in a day-care center in a rural community where less than 7 per cent of the population possessed anti-HAV. Serotesting for IgM specific antibody to hepatitis A virus identified 78 cases in center attendees, staff, and families. Thirty-five per cent of the center children were seropositive. In children under age three anicteric infection was at least 17 times more frequent than icteric infection, but in older children and adults icterus was a predominant manifestation of the disease. Clinical suspicion should be high in any day-care child with nausea, emesis, diarrhea, or arthralgia. The low incidence of icterus in infected children suggested that outbreak reports reaching public health departments are likely to be incomplete and poorly indicative of outbreak magnitude. The high frequency of intrafamilial transmission and anicteric infection appeared to justify administration of immune serum globulin to household contacts of center children under age three when a day-care outbreak is detected. (*Am J Public Health* 1983; 73:1190–1194.)

Introduction

Endemic and epidemic hepatitis A infection is well documented among institutionalized children, and is increasingly reported in children attending day-care centers.[1–4] Such children frequently transmit infection to close adult contacts, and have been reported as a source of up to 30 per cent of reported hepatitis A cases in one community.[5] Previous studies have noted that hepatitis A in young children is usually subclinical, emphasizing the fact that center outbreaks were not identified until adult cases occurred.[5,6]

We recently studied a large day-care center associated outbreak of hepatitis A in a rural community using serotesting for IgM specific antibody to hepatitis A virus (anti-HAV). This report provides further data on the spectrum of disease in children with hepatitis A, and on the frequency of anicteric hepatitis in this age group.

Methods

Outbreak Description

The outbreak occurred in an agricultural community of 22,000, which had recorded an average of 14 cases of hepatitis A per year during the past decade. The day-care center had a licensed capacity of 60 children and a staff of 13 adults. The center was housed in a renovated residential structure where children were segregated by age during most of the day, including meal time. During the outbreak period a total of 225 children attended the center. Of these, 34 per cent were age three or younger and 63 per cent were between four and six years of age. Most children attended less than two days per week with an average daily attendance of 50. No center enrollees attended another day-care center during the outbreak. Ten to 15 diapered children were cared for by three full-time staff. Personnel caring for young children did not participate in food preparation. Designated diaper changing areas were adequate, and careful staff hand washing practices were observed. There was no history of previous hepatitis A at the facility.

Reports of two cases among center staff in late December stimulated an investigation by health officials. All physician-confirmed hepatitis cases were evaluated for association with the center outbreak. Center employees and parents of all center children were questioned regarding icteric illness. Hygienic control measures were recommended and a moratorium was placed on center enrollment. Immune globulin (IG) containing non-IgM anti-HAV was administered to all center personnel and children, household contacts of cases, and household contacts of center children under age three.

Serologic Investigation

All families of center children and staff were invited to donate serum for antibody assay. Samples were obtained from 93 of 225 center children (all anicteric), 11 anicteric employees, and 125 of 300 household contacts. The center children in this group accounted for 65 per cent of all center attendance during the outbreak. One hundred and twenty-four individuals from 30 families were recruited for a control group from which to assess community prevalence of anti-HAV. While neither individuals nor families who volunteered participation were randomly selected, the samples comprising the study and control groups were representative of the center-related population in age distribution and annual per capita income.

A total of 353 serum specimens were collected by venipuncture between January 15, 1981 and February 15, 1981. Frozen aliquots were shipped to the Centers for Disease Control, Hepatitis and Viral Enteritis Division, and the University of Utah Medical Center Clinical Laboratories for anti-HAV assay. Commercially available kits, HAVAB and HAVAB-M* (Diagnostics Division, Abbott Laboratories, North Chicago, IL 60064), were used to detect the presence of anti-HAV and IgM anti-HAV respectively.

Case Definitions

A reported case of hepatitis was any physician diagnosed case of hepatitis A.

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*Use of trade names is for identification only and does not imply endorsement by the US Public Health Service or the US Department of Health and Human Services.

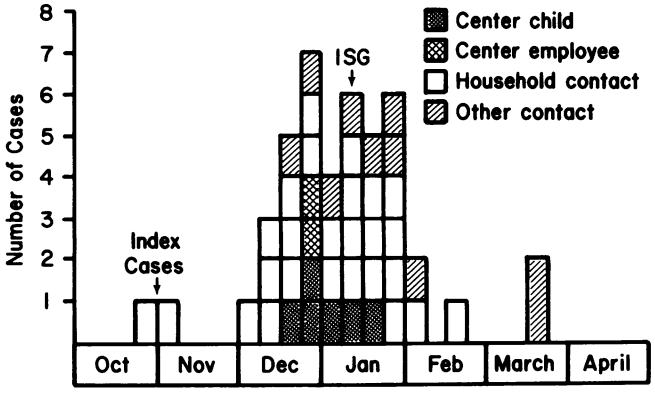

FIGURE 1—Day-Care Center Associated Outbreak of Hepatitis A: Cases of Hepatitis A Diagnosed by Physicians and Reported to South Central Idaho Health District

An icteric case of hepatitis was any case in which icterus was noted by the physician.

An anicteric case was either:

1) Any person shown by serotesting to have IgM anti-HAV, who on questioning had not noted jaundice (61 cases); or
2) A day-care child having only IgG anti-HAV on serotesting and at least one non-center attending household member with documented hepatitis during the outbreak (4 cases).

A 6-month-old child with IgG anti-HAV was excluded from study because no immediate family members possessed anti-HAV.

Results

Ninety-seven cases of hepatitis A occurred in the South Central Idaho Health District between October 1980 and April 1981. Forty-two center-related cases were reported by physicians and Health Department personnel. An additional 33 cases were identified by serologic testing. Thus, 75 of the 97 cases were center-related. The remaining 22 cases represented a significant increase over the average seasonal incidence of eight, but could not be definitely attributed to center exposure.

Antibody Prevalence

Antibody assay of control group sera revealed a significant lack of prior community exposure to HAV. Only nine of 129 (7 per cent) possessed anti-HAV. Of these, six positive samples were from a single family with known previous involvement in a common source outbreak. No other child carried antibody to HAV.

Transmission

Earliest documented cases were identified in a household with known common-source exposure in another community during early October. Hepatitis A was diagnosed in both parents during the first week of November. Their diapered children, aged 1 and 2, enrolled in the center in mid-October and attended intermittently thereafter. Although the children had remained asymptomatic, both were subsequently shown to possess anti-HAV.

Spread of infection within the center appears to have progressed primarily from infant to infant as icteric cases were noted among parents of diapered center children prior to onset of symptoms in center employees (Figure 1). The four infected staff members were not primarily involved in the care of diapered children, but did attend children who were subsequently shown to have been infected. The outbreak, shown in Figure 1, began in October and was recognized in late December. Control measures were initiated in early January, and the last related cases were observed in March.

Infection rates for center children, staff, and their household contacts were calculated both on the basis of case reports and serologic testing (Table 1). While infection rates derived from case reports were lowest among preschool children, their infection rates established by serotesting were actually higher than among their older household contacts.

Early in the outbreak, reported cases showed a close relation to diapered children; 19 (86 per cent) of the first 22 cases had extensive contact with such children. At mid-outbreak, cases of icteric illness were observed in older center children. Of the last 22 cases, only nine (41 per cent) had known exposure to center children younger than age three. These findings suggest that virus was initially spread by anicteric diapered children with subsequent increasing involvement of older children and adults.

TABLE 1—Occurrence of Hepatitis Type A among Persons Associated with a Day-Care Center Outbreak in Twin Falls, Idaho from November 1980 to January 1981

		Center-Related Reported Cases			Center-Related Seroconfirmed Cases		
Age	Population At Risk	Number Tested	Number Positive	Per Cent Apparent Attack Rate	Number Tested	Number Positive	Per Cent Attack Rate
0–3	76	0	0	0	46	17	37
4–6	142	0	6†	4	43	13	30
7–10	27*	0	3	11	4	1	25
Adult Contacts	300	6	31	10	125	6	4
Center Staff	13	2	2	15	11	4	36
Total	558	8	42	8	229	41	17

*Exposed children ages 7–10 included seven center attendees and 20 household contacts of center children.
†Two reported cases were anicteric.

TABLE 2—Ratios of Anicteric to Icteric Infection with Hepatitis Type A Virus during a Day-Care Center Associated Outbreak in Twin Falls, Idaho from October 1980 to January 1981

Age	Icteric Cases	Nonicteric Seroconfirmed Cases	Ratio of Anicteric to Icteric Infection	Corrected Ratio of Anicteric to Icteric Infection*
0–3	0	17	>17:1	>20:1
4–6	4	13	3:1	9:1
7–10	3	1	1:3	1:3
>15	33	4	1:8.5	1:4

*Corrected for portion of population at risk participating in serotesting.

Clinical Manifestations

Icterus was uncommon among infected preschool children in this study. No icteric infections occurred in center children under three years of age, and only four occurred in children age four to six. Ratios of anicteric to icteric infection were calculated using reported and serodiagnosed cases (Table 2). The observed ratios represented minimum values, since they included all cases of icteric hepatitis, but only the fraction of anicteric illness that occurred in the serotested group. Therefore, the ratios were normalized for total center attendance (corrected ratio). In children under three years of age, anicteric infection was at least 17 times more common than icteric infection, and if a similar incidence of anicteric infection occurred in untested children, the ratio approached 20 to 1. Icterus was more common with increasing age, becoming the typical clinical manifestation in the seven-to-ten-year olds and the predominant form of illness in adults.

When symptom reports of anicteric, IgM anti-HAV positive children were compared with those of seronegative center attendees over the period of the outbreak, significantly higher frequencies of diarrhea, nausea, emesis, arthralgia, and malaise were noted in the infected children (Table 3). Only five seropositive children (21 per cent) had no reported symptoms. However, no single symptom or symptom complex reliably identified seropositive children.

Discussion

Major characteristics of this outbreak, including specific age-infectivity rates and intrafamilial transmission trends, are similar to those described in New Orleans and Phoenix.[5,6] However, this study demonstrates the greater impact of such an outbreak in an immunologically naive community.

Studies of urban populations have shown anti-HAV to be present in approximately 45 per cent of persons screened. Although this figure has often been cited as typical of US immunity prevalence,[9,10] it is reasonable to expect lower rates in non-urban settings. In this community, only 7 per cent of individuals in a representative control group possessed anti-HAV. If a single family with known history of HA is excluded, the rate becomes less than 2 per cent and may more closely reflect true community antibody prevalence. Such a communiy is particularly susceptible to HA outbreaks.

A major factor facilitating day-care outbreaks is failure to recognize the disease among children. Although the occurrence of anicteric infection has been thoroughly and repeatedly documented, clinical diagnosis of hepatitis A continues to be nearly synonomous with "yellow jaundice." During this study, no diagnosis of hepatitis was made in the absence of icterus until media attention to the outbreak enhanced clinical suspicion. Even then, only 6 per cent (two of 35) of anicteric cases were diagnosed, while 95 per cent (38 of 40) of icteric cases were recognized and reported. Since only half of the projected population at risk was screened for anicteric infection, probably less than one-half of infections were documented. Clinical diagnosis reliably recognized adult cases but consistently overlooked hepatitis in preschool children. Our data indicated, however, that anicteric infection was not typically asymptomatic. While

TABLE 3—Symptoms Reported for Anicteric Persons Aged 0–6 Years during Outbreak of Hepatitis Type A in Twin Falls, Idaho from October 1980 to January 1981

Symptom	Seropositive N = 24	Seronegative Associated with Outbreak N = 65	P
Diarrhea	10(42)*	7(11)*	<.005
Nausea	12(50)	7(11)	<.005
Arthralgia	8(33)	4 (6)	<.005
Malaise	13(54)	15(22)	<.025
Emesis	7(20)	6 (7)	<.05
Fever	12(50)	18(28)	>.05 N.S.
Abdominal Pain	6(25)	10(15)	>.25 N.S.
Rash	1 (4)	3 (5)	>.50 N.S.
None	5(21)	22(34)	>.25 N.S.

*Numbers in parentheses are percentages.

complaints were nonspecific, there was a 95 per cent chance that the infected child had symptoms of gastrointestinal illness.

In summary icterus is not an adequate indicator of HAV infection in children, and clinical suspicion should be high in any day-care-attending child with nausea, emesis, diarrhea, or arthralgia. Absence of icterus should not discourage the early use of specific diagnostic tests, including measurement of IgM anti-HAV. During an outbreak, reports reaching public health departments are likely to be incomplete and poorly indicative of outbreak magnitude. Therefore, the public health official must have a high index of suspicion for child-transmitted disease and all reported cases should be investigated for contact with young children. The frequency of intrafamilial transmission and anicteric infection appears to justify administration of ISG to household contacts of center children under age three when a day-care outbreak is detected.

No reservoir or carrier state has been identified for HAV. Dienstag has pointed out the possibility of viral perpetuation due to a large number of undetected anicteric infections.[12] Our data suggest that such a population would be predominantly composed of preschool children. Anicteric HA occurred in only 13 per cent of infected adults, an incidence insufficient to account for a significant pool of undetected infection. Among preschool children, anicteric HA occurred at least 30 times more frequently than among their adult counterparts. Thus, preschool children appear to play a most significant role in transmission of HA, and control measures must be adapted to their special characteristics.

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New York-Cornell Becomes Center for AIDS Study

Cornell University Medical College (CUMC) has been awarded a three-year grant of $1.3 million by the National Institutes of Health to study AIDS/Kaposi's sarcoma patients. The new infusion of federal funds will allow multi-faceted research into the mechanisms of AIDS.

According to the NIH, the grant is for immunologic and epidemiologic studies aimed at understanding the factors responsible for the altered immune function in AIDS patients. The research team from CUMC will also compare the disease in Haiti with the disease in the United States to determine if it has the same basic characteristics and epidemiology. The ultimate goal is to control and eradicate the disease, which is expected to be more widespread in the future.

The CUMC program, headed by Dr. Gordon Douglas, Chairman of the Department of Medicine, involves an interinstitutional study, including investigators from the Rockefeller University and Memorial Sloan-Kettering Cancer Center.

The NIH has recently awarded a series of collaborative research grants; a total of $9.6 million has been allocated nationwide in this program for the study of the disease and its epidemiology. Of that total, $4.4 million is being awarded by the National Cancer Institute and $4.1 million by the National Institute of Allergy and Infectious Diseases. Other NIH institutes account for the remainder.

Additional recipients of NIH awards for the study of AIDS are: James Mullins, PhD, Harvard University; Frederick Siegel, MD, Mt. Sinai Medical Center; Paul Volberding, MD, University of California at San Francisco; Ayer Rubenstein, MD, Yeshiva University; and John Farley, MD, University of California at Los Angeles.